EMERGING TECHNOLOGY
SPACE-BASED RANGE COMMAND AND TELEMETRY PROCESSOR

Kennedy Space Center has developed a close partnership with Wallops Flight Facility and is working closely with Wallops on a current project to develop a light weight, low power range safety unit for use in space-based applications. The range safety unit will show that with today's technologies, it is possible to meet both the range safety requirements and the space application requirements of size, weight, and power. The range safety unit will have the following capabilities:

- Receive and process forward link commands
- Receive and process GPS data
- Send return link data via a satellite relay that meets the required link margin for range safety

It is anticipated that the first test flight of the range safety unit will be on a sounding rocket.

The range safety unit is based on an integrated architecture and consists of four circuit boards using the latest technologies. The first board is the modulator board being developed by Wallops Flight Facility. This board provides the radio front-end functions. The second board is the command and telemetry processor being developed by Kennedy Space Center's Advanced Development System Division. This board provides the processing functions.

The commercially available GPS receiver is the third board and the fourth board is the power management board also being developed by Wallops Flight Facility. The power management board converts the standard 28 voltage input to the appropriate voltages. The boards are contained in an enclosure that is less than 125 cubic inches and weighs less than six pounds.

Command and Telemetry Processor Design

The command and telemetry processor design is based on a field programmable gate array with an embedded processor core. The field programmable gate array provides the flexibility that allows the command and telemetry processor to be programmed for different functions and the processor is used to execute code. The command and telemetry processor receives forward link commands via the modulator board interface and processes the commands in the field programmable gate array. Similarly, the command and telemetry processor receives GPS data via the GPS board interface and processes the data in the field programmable gate array.

For the return link, the command and telemetry processor formats and sends return link data to the modulator board that includes range safety unit status data, command status data, and GPS data. One Ethernet and several serial interfaces are available on the command and telemetry processor for control and data exchange. The field

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programmable gate array is programmed through a standard Joint Test Action Group (JTAG) interface available on the command and telemetry processor.

Command and Telemetry Processor Development

The command and telemetry processor is currently in the development phase where the design and implementation of the circuit board has been completed as shown below. The design and programming of the field programmable gate array is partially complete where the serial interface, Ethernet interface, GPS interface, configuration EPROM functions and boot flash functions have been implemented. Once the command and telemetry processor and GPS boards have been tested together, the rest of the boards will be integrated and a functional test will be performed on the range safety unit.